Screening Quick Reference Tables

This set of NOAA **Screening Quick Reference Tables**, or SQuiRTs, presents screening concentrations for inorganic and organic contaminants in various environmental media. Guidelines for sample preservation and options for laboratory analytical techniques are also included.

The SQuiRT cards were developed for internal use by the Coastal Protection & Restoration Division (CPR) of NOAA. The CPR Division identifies potential impacts to coastal resources and habitats likely to be affected by hazardous waste sites. To initially identify substances which may threaten resources of concern to NOAA, environmental concentrations are compared to these screening levels. These tables are intended for preliminary screening purposes only: they do not represent official NOAA policy and do not constitute criteria or clean-up levels. NOAA does not endorse their use for any other purposes. Screening levels are reported with the number of significant figures they were originally reported with.

Further guidance on the recommended application of various screening guidelines is provided in the supporting source documentation (listed on the last page of each section). Users of the SQuiRT cards are strongly encouraged to review supporting documentation to determine appropriateness for their specific use.

The SQuiRT card set is organized into the following sections:

- Inorganics in Solids (freshwater and marine sediment, plus soil)
- Inorganics in Water (groundwater and surface water)
- Organics in Water and Solids
- Analytical Methods for Inorganics
- Analytical Methods for Organics
- Guidelines for Sample Collection & Storage

For surface water samples, the CPR Division compares measured contaminant concentrations to their applicable, EPA Ambient Water Quality Criteria (AWQC) for the protection of aquatic organisms. Because releases from hazardous waste sites are often continuous and long-term, concentrations are compared directly with the chronic AWQC, when available. SQuiRTs for trace element AWQCs have been updated to show values for just filtered samples, as well as the formulae to calculate exact criteria for elements whose criteria are hardness-dependent. Groundwater concentrations are also screened against AWQC. However, given the dilution expected during migration and upon discharge of groundwater to surface water, CPRD uses 10 times the applicable AWQC for screening. If available, suitable site-specific dilution factors are used. Maximum Contaminant Levels (MCLs), applicable to drinking water sources and secondary MCLs applicable to groundwater, are also provided on the SQuiRT cards.

Promulgated criteria similar to the AWQC are generally not available for contaminated soils or sediments. For screening purposes, inorganic contaminant levels in soils are compared to the average concentrations found in natural soils of the United States. Organic compounds in soil are screened against risk-based Canadian soil standards. Soil standards for different land use categories are listed to provide perspective. Soil values are not used by NOAA to estimate aquatic exposures. NOAA screens soil concentrations only to estimate which contaminants may be elevated and thus represent potential contaminant sources to aquatic habitats of concern.

Multiple sediment screening values have been included in the NOAA SQuiRTs to help portray the entire spectrum of concentrations which have been associated with various probabilities of adverse biological effects. This spectrum ranges from presumably non-toxic e.g., trace metal levels reported to represent non-anthropogenically

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Screening Quick Reference Table for Inorganics in Solids

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(values in ppb dry weight)

COMPOUND	FRESHWATER SEDIMENT					MARINE SEDIMENT					SOIL	
	"Background" [1]	Lowest ARCs *H. azteca* TEL	Threshold Effects Level (TEL)	Probable Effects Level (PEL)	Upper [2] Effects Threshold (UET)	Threshold Effects Level (TEL)	Effects Range-Low (ERL)	Probable Effects Level (PEL)	Effects Range Median (ERM)	Apparent [3] Effects Threshold (AET)	Background	
											Geometric Mean	Range
Predicted Toxicity Gradient:		Increasing →				Increasing →						
ALUMINUM (Al) (%)	0.26%	2.55%								1.8% N	4.7%	0.5- >10%
ANTIMONY (Sb)	160				3,000 M					9,300 E	480	bd-8,800
ARSENIC (As)	1,100	10,798	5,900	17,000	17,000 I	7,240	8,200	41,600	70,000	35,000 B	5,200	bd-97,000
BARIUM (Ba)	700									48,000 A	440,000	10,000-0.5%
CADMIUM (Cd)	100-300	583	596	3,530	3,000 I	676	1,200	4,210	9,600	3,000 N		
CHROMIUM (Cr)	7,000-13,000	36,286	37,300	90,000	95,000 H	52,300	81,000	160,400	370,000	62,000 N	37,000	1000-0.2%
COBALT (Co)	10,000									10,000 N	6,700	bd-70,000
COPPER (Cu)	10,000-25,000	28,012	35,700	197,000	86,000 I	18,700	34,000	108,200	270,000	390,000 MO	17,000	bd-700,000
IRON (Fe) (%)	0.99-1.8 %	18.84%			4% I					22% N	1.8%	0.01- >10%
LEAD (Pb)	4,000-17,000	37,000	35,000	91,300	127,000 H	30,240	46,700	112,180	218,000	400,000 B	16,000	bd-700,000
MANGANESE (Mn)	400,000	630,000			1,100,000 I					260,000 N	330,000	bd-0.7%
MERCURY (Hg)	4-51		174	486	560 M	130	150	696	710	410 M	58	bd-4,600
NICKEL (Ni)	9,900	19,514	18,000	35,900	43,000 H	15,900	20,900	42,800	51,600	110,000 EL	13,000	bd-700,000
SELENIUM (Se)	290									1,000 A	260	bd-4,300
SILVER (Ag)	<500				4,500 H	730	1,000	1,770	3,700	3,100 B		
STRONTIUM (Sr)	49,000										120,000	bd-0.3%
TIN (Sn)	5,000									> 3,400 N as TBT	890	bd-10,000
VANADIUM (V)	50,000									57,000 N	58,000	bd-500,000
ZINC (Zn)	7,000-38,000	98,000	123,100	315,000	520,000 M	124,000	150,000	271,000	410,000	410,000 I	48,000	bd-0.29%
SULFIDES					130,000 M					4,500 MO		

1 "Background" values are derived from a compilation of sources, but come primarily from Int. Joint Comm. Sediment Subcommittee (1988).

2 Entry is lowest, reliable value among a compilation of AET levels: I - Infaunal community impacts; H - *Hyalella azteca* bioassay; M - Microtox bioassay

3 Entry is lowest value among AET levels: I - Infaunal community impacts; A-Amphipod; B-Bivalve; M-Microtox; O-Oyster larvae; E-Echinoderm larvae; L-Larval$_{max}$; or , N-*Neanthes* bioassays

SOURCES:

Sediment: PTI Environ. Serv., Contaminated Sediments Criteria Rpt., 1989; Wash. Dept. Ecol. Publ. 95-308, 1995 and 97-323a, 1997; J. Great Lakes Res. 22(3):624-638, 1996; Gries & Waldow, Puget Sound Dredged Disposal Analysis Rpt., 1996; Environ. Manage. 19(1):81-97, 1996; The AET Approach; Briefing Rpt. to the EPA SAB, Sept. 1988; Int. Joint Comm., Procedures for Assessment of Contaminated Sediment in the Great Lakes, 1988; Ecotox. (5):253-278, 1996; EPA Rpt. 905-R96-008, Sept. 1996.; WAC Chapter 173-204; J. Great Lakes Res. 22(3):602 - 623, 1996.

Soil: Shacklette and Boerngen 1984; USGS Prof. Paper 1270: bd denotes below detection limits.

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(values in ppb)

Screening Quick Reference Table for Inorganics in Water

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TRACE ELEMENT	GROUND WATER	SURFACE WATER				NOTES
		Freshwater		*Marine*		
	Maximum Contaminant Levels (MCLs)	CMC "acute"	CCC "chronic"	CMC "acute"	CCC "chronic"	→ denotes changes from previous to recent recommneded values (i.e., previous → new). Where there was no previous value, → denotes the new recommendation.
ALUMINUM (Al)	50–200 •	pH 750	pH 87			For pH 6.5 to 9.0 and expressed as total recoverable.
ANTIMONY (Sb)	6	88 p	30 p	1500 p	500 p	
ARSENIC (As^{+5})	≤ 50	850*		2319*		LOELs from 50 FR 30789.
ARSENIC, total ◆	50	→ 340	→ 150	→ 69	→ 36	Toxicity values derived for arsenic III are now applied to total arsenic.
BARIUM (Ba)	2000					
BERYLLIUM (Be)	4	130*	5.3*			LOELs from 45 FR 79326.
CADMIUM (Cd) ◆	5	3.9 → 4.3 †	1.1 → 2.2 †	43 → 42	9.3	Marine values represent change to filtered basis.
CHROMIUM (Cr^{+3}) ◆	≤ 100	1700 → 570 †	210 → 74 †	10300*		
CHROMIUM (Cr^{+6}) ◆	≤ 100	16	11	1079 → 1100	50	Marine values represent change to filtered basis.
CHROMIUM, total	100					
COPPER (Cu) ◆	1300 p	18 → 13 †	12 → 9 †	2.9 → 4.8	→ 3.1	
IRON (Fe)	300		1000			
LEAD (Pb) ◆	15 p	83 → 65 †	3.2 → 2.5 †	217 → 210	8.5 → 8.1	Values represent change to filtered basis.
MANGANESE (Mn)	50 •					
MERCURY (Hg) ◆	2	2.4 → 1.4	0.012 → 0.77	2.1 → 1.8	0.025 → 0.94	Derived from inorganic, but applied to total mercury. Does not account for food web uptake.
NICKEL (Ni) ◆	100	1400 → 470 †	160 → 52 †	75 → 74	8.3 → 8.2	Marine values represent change to filtered basis.
PHOSPHORUS (P)					0.1	For elemental phosphorus.
SELENIUM (Se) ◆	50	13-186 total	5 total	294 → 290	71	Freshwater CMC depends on ratio of selenite to selenate. Marine values represent change to filtered basis. Marine CCC does not account for food web uptake, so monitor fish community if > 5.0 µg/L.
SILVER (Ag) ◆	100 •	4.1 → 1.7 † ❷	0.12	2.3 → 0.95 ❷		CMCs has been divided by two to be comparable to 1985 derivations.
THALLIUM (Tl)	2	1400*	40*	2130*		LOELs from 45 FR 79340.
Tin as TBT		0.46	0.063	0.37	0.01	
ZINC (Zn) ◆	5000 •	120 †	110 → 120 †	95 → 90	86 → 81	Marine values represent change to filtered basis.
Hydrogen Sulfide		2.0		2.0		
Cyanide, free (CN)	200	22	5.2	1	1	

p - proposed * - Lowest Observable Effect Level (not a criterion) • - National Secondary Drinking Water Regulations ❷ - CMC has been halved to be comparable to criteria derived using 1985 Guidelines

◆— Expressed as dissolved (passing filtered through a 0.45 mm filter) and calculated from total recoverable by applying a conversion factor except as noted

† Hardness-dependent value with 25 mg/L as minimum & 400 mg/L as maximum calcium carbonate; value entered is for 100 mg/L calcium carbonate. Use equations to determine exact criteria.

For salinity between 1 and 10 ppt, use the more stringent of either fresh or marine values.

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(values in ppb)

Screening Quick Reference Table for Inorganics in Water

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TRACE ELEMENT	HARDNESS CALCULATIONS FOR FILTEREED FRESHWATER CRITERIA		UNFILTERED TO FILTERED CALCULATIONS CONVERSION FACTORS		
	CMC	CCC	Fresh CMC	Fresh CCC	Marine CMC/CCC
ARSENIC (As)			CF = 1	CF = 1	CF = 1
CADMIUM (Cd)	$CMC = e^{1.128\,[\ln(\text{hardness})] - 3.6867}$	$CCC = e^{0.7852\,[\ln(\text{hardness})] - 2.715}$	CF = 1.136672 - 0.041838 [ln(hardness)]	CF = 1.101672 - 0.041838 [ln(hardness)]	CF = 0.994
CHROMIUM III (CR^{+3})	$CMC = e^{0.819\,[\ln(\text{hardness})] + 3.7256}$	$CCC = e^{0.819\,[\ln(\text{hardness})] + 0.6848}$	CF = 0.316	CF = 0.860	
CHROMIUM VI (Cr^{+6})			CF = 0.982	CF = 0.962	CF = 0.993
COPPER (Cu)	$CMC = e^{0.9422\,[\ln(\text{hardness})] - 1.7}$	$CCC = e^{0.8545\,[\ln(\text{hardness})] - 1.702}$	CF = 0.960	CF = 0.960	CF = 0.83
LEAD (Pb)	$CMC = e^{1.273\,[\ln(\text{hardness})] - 1.46}$	$CCC = e^{1.273\,[\ln(\text{hardness})] - 4.705}$	CF = 1.46203 - 0.145712 [ln(hardness)]	SAME AS CMC	CF = 0.951
MERCURY (Hg)			CF = 0.85	CF = 0.85	CF = 0.85
NICKEL (Ni)	$CMC = e^{0.846\,[\ln(\text{hardness})] + 2.255}$	$CCC = e^{0.846\,[\ln(\text{hardness})] + 0.0584}$	CF = 0.998	CF = 0.997	CF = 0.990
SELENIUM (Se)			The freshwater criteria are expressed as total recoverable: a CF of 0.922 may be used.		CF = 0.998
SILVER (Ag)	$CMC = e^{1.72\,[\ln(\text{hardness})] - 6.52}$	CCC — No criteria	CF = 0.85		CF = 0.85
ZINC (Zn)	$CMC = e^{0.8473\,[\ln(\text{hardness})] + 0.884}$	$CCC = e^{0.8473\,[\ln(\text{hardness}) + 0.884}$	CF = 0.978	CF = 0.986	CF = 0.946

Freshwater criterion for certain metals are expressed as a function of hardness (mg/L) in the water column. The values shown on page 3 assume 100 mg/L. Values for a different hardness may be calculated using the above equations to arrive at a CMC or CCC for *filtered* samples. Hardness may range from 25 to 400 mg/L as calcium carbonate. For hardness outside this range, use 25 and 400 mg/L as the minimum and maximum value allowed.

Criteria for most metals are expressed as standards for samples filtered through 0.45 µm filter (*i.e.*, "dissolved"). To convert unfiltered concentrations to filtered, multiply the unfiltered concentration value by the appropriate Conversion Factor (CF) above. For cadmium and lead, the conversion factor itself is hardness-dependent.

For salinity between 1 and 10 ppt, use the more stringent of either fresh or marine values.

CMC – Criteria Maximum Concentration is the highest level for a 1-hour average exposure not to be exceeded more than once every three years, and is synonymous with "acute."

CCC – Criteria Continuous Concentration is the highest level for a 4-day average exposure not to be exceeded more than once every three years,and is synonymous with "chronic."

Sources:

MCL EPA 810-F-94-001A
EPA 570/9-91-019FS

AWQC: Fed. Reg. 4 May 1995, Vol. 60 (86): 22229-22237; Fed. Reg. 10 Dec 1998 Vol. 63(237:) 68353 - 68364
US EPA, Quality Criteria for Water Summary 1994,
EPA Health and Ecological Criteria Division

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Screening Quick Reference Table for Organics

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(all sediment and soil values in ppb dry weight, except as noted)

CHEMICAL	CAS No.	WATER: Maximum Contaminent Level	WATER: Ambient Water Quality Criteria [1] Freshwater CMC	WATER: Freshwater CCC	WATER: Marine CMC	WATER: Marine CCC	SEDIMENT: Freshwater Sediment | Marine Sediment: Lowest ARCs *H. azteca* TEL	Threshold Effects Level (TEL)	Probable Effects Level (PEL)	Upper [2] Effects Threshold (UET)	Threshold Effects Level (TEL)	Effects Range-Low (ERL)	Effects Range-Median (ERM)	Probable Effects Level (PEL)	Apparent [3] Effects Threshold (AET)	SOIL: Agricultural [4] Target	Urban park / Residential [4] Target
CHLORINATED DIOXINS & PCBS																	
TCDD 2,3,7,8-	1746016	0.00003	<0.01*	<0.00001*						0.0088†H					0.0036 N	0.01	1
POLYCHLORINATED BIPHENYLS	1336363	0.5	2	0.014	10	0.03	31.62	34.1	277	26 M	21.55	22.7	180	188.79	130 M	500	5000
SEMIVOLATILES																	
BENZIDINE	92875		2500*														
BENZOIC ACID	65850														65 O		
BENZYL ALCOHOL	100516														52 B		
CHLOROANILINE 4-	106478		250*C	50*C	160*C	129*C											
DIBENZOFURAN	132649									5100 H					110 E		
DIPHENYLHYDRAZINE 1,2-	122667		270*														
ISOPHORONE	78591		117000*		12900*												
SEMIVOLATILE, NITROAROMATICS																	
DINITROTOLUENE 2,4-	121142		330*	230*	590* S	370*S											
NITROBENZENE	98953		27000*		6680*										21 N		
N-NITROSODIPHENYLAMINE	86306		5850C*		3300000*C										28 I		
SEMIVOLATILE, ORGANOCHLORINES																	
ALDRIN	309002		1.5 ❷		0.65 ❷					40 I					9.5 AE		
CHLORDANE	57749	2	1.2 ❷	0.00215 ❷	0.045 ❷	0.002 ❷		4.5	8.9	30 I	2.26	0.5	6	4.79	2.8 A		
CHLORONAPHTHALENE 2-	91587		1600* C		7.5* C												
p,p-DDD (TDE)	72548		0.6*		3.6*			3.54	8.51	60 I	1.22	2	20	7.81	16 I		
p,p-DDE	72559		1050*		14*			1.42	6.75	50 I	2.07	2.2	27	374.17	9 I		
p,p-DDT	50293		0.55 ❷	0.0005 ❷	0.065 ❷	0.0005 ❷				< 50 I	1.19	1	7	4.77	12 E		
DDT, total								6.98	4450	50 I	3.89	1.58	46.1	51.7	11 B		
DIELDRIN ‡	60571		0.24	0.056	0.355 ❷	0.00095 ❷		2.85	6.67	300 I	0.715	0.02	8	4.3	1.9 E		
ENDOSULFAN (α + β)	115297		0.11 ❷	0.028 ❷	0.017 ❷	0.00435 ❷											
ENDRIN ‡	72208	2	0.086	0.036	0.0185 ❷	0.00115 ❷		2.67	62.4	500 I							
HEPTACHLOR	76448	0.4	0.26 ❷	0.0019 ❷	0.0265 ❷	0.0018 ❷				10 I					0.3 B		
HEPTACHLOR EPOXIDE	1024573	0.2	0.26 ❷	0.0019 ❷	0.0265 ❷	0.0018 ❷		0.6	2.74	30 I							
HEXACHLOROBENZENE	118741	1	6 p	3.68 p	160*C	129*C				100 I					6 B	50	2000
HEXACHLOROBUTADIENE	87683		90*	9.3*	32*										1.3 E		
HEXACHLOROCYCLOHEXANE (BHC)	608731		100*		0.34*					100 I						50	2000

‡ — EPA Proposed Criteria, based on Equilibrium Partitioning, for Dieldrin are 11,000 and 20,000, and for Endrin are 4,200 and 760 µg/kg O.C. in freshwater and marine sediment, respectively.

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; ❷ - CMC has been halved to be comparable to criteria derived by 1985 Guidelines.

2 Entry is lowest, reliable value among AET tests, on 1% TOC basis: I - Infaunal community impacts; M - Microtox bioassay; H - *Hyalella azteca* bioassay; † - value on dry weight basis.

3 Entry is lowest value among AET tests: I - Infaunal community impacts; A-Amphipod; B-Bivalve; M-Microtox; O-Oyster larvae; E-Echinoderm larvae; L-Larval $_{max}$; or, N- *Neanthes* bioassays.

4 Residues greater than target require remediation to levels below target for applicable land use in British Columbia: 'A' denotes a soil value intended to protect adjacent, aquatic habitat.

Screening Quick Reference Table for Organics

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HEXACHLOROCYCLOPENTADIENE	77474	50	7*	5.2*	7*												
HEXACHLOROETHANE	67721		980*	540*	940*										73 BL		
LINDANE	58899	0.2	0.95	0.08	0.08 ❷			0.94	1.38	9 I	0.32			0.99	> 4.8 N		
METHOXYCHLOR	72435	40		0.03		0.03											
MIREX	2385855			0.001		0.001				800 I							
PENTACHLOROBENZENE	608935		250*C	50*C	160*C	129*C										100	1000
TETRACHLOROBENZENE 1,2,4,5-	95943		250*C	50*C	160*C	129*C										100	1000
TOXAPHENE	8001352	3	0.73	0.0002	0.21	0.0002											
SEMIVOLATILE, ORGANOPHOSPHATES																	
CHLORPYRIFOS	2921882		0.083	0.041	0.011	0.0056											
MALATHION	121755			0.1		0.1											
PARATHION MIXTURE	56382		0.065	0.013													
SEMIVOLATILE, PHENOLICS																	
CHLOROPHENOL 2-	95578		4380*												8 A	50	500
DICHLOROPHENOL 2,4-	120832		2020*	365*											5 A	50	500
DIMETHYLPHENOL 2,4-	105679		2120*												18 N	100	1000
DINITROPHENOL	51285		230*C	150*C	4850*C											100	1000
METHYL PHENOL 2- [O-CRESOL]	95487														8 B	100	1000
METHYL PHENOL 4- [p-CRESOL]	106445														100 B	100	1000
NITROPHENOL 4-	100027		230*C	150*C	4850*C											100	1000
PENTACHLOROPHENOL [at pH7.8 ‡]	87865	1.0 p	19 pH	15 pH	13	7.9									17 B	35 A pH	35 A pH
PHENOL	108952		10200*	2560*	5800*					48 † H					130 E	100	1000
TETRACHLOROPHENOL 2,3,4,6-	58902				440*											50	500
TRICHLOROPHENOL 2,4,5-	95954		100 p	63 p	240 p	11 p									3 I	50	500
TRICHLOROPHENOL 2,4,6-	88062			970*											6 I	50	500
SEMIVOLATILE, PHTHALATES																	
BUTYL BENZYL PHTHALATE	85687		940*C	3*C	2944*C	3.4*C									63 M		
DI[2-ETHYLHEXYL] PHTHALATE	117817	6	400 p	360 p	400 p	360 p				750 †M	182.16			2646.51	1300 I		
DIETHYL PHTHALATE	84662		940*C	3*C	2944*C	3.4*C									6 BL		
DIMETHYL PHTHALATE	131113		940*C	3*C	2944*C	3.4*C									6 B		
DI-N-OCTYL PHTHALATE	117840		940*C	3*C	2944*C	3.4*C									61 BL		
DI-N-BUTYL PHTHALATE	84742		940*C	3*C	2944*C	3.4*C				110 H					58 BL		

‡ — For PCP, freshwater CMC= $e^{1.005pH - 4.869}$ and CCC = $e^{1.005pH - 5.134}$

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; ❷ - CMC has been halved to be comparable to criteria derived by 1985 Guidelines.

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		WATER					SEDIMENT									SOIL	
							Freshwater Sediment				Marine Sediment						
CHEMICAL	CAS No.	Maximum Contaminent Level	Ambient Water Quality Criteria [1] Freshwater CMC	Freshwater CCC	Marine CMC	Marine CCC	Lowest ARCs *H. azteca* TEL	Threshold Effects Level (TEL)	Probable Effects Level (PEL)	Upper [2] Effects Threshold (UET)	Threshold Effects Level (TEL)	Effects Range-Low (ERL)	Effects Range-Median (ERM)	Probable Effects Level (PEL)	Apparent [3] Effects Threshold (AET)	Agri-cultural [4] Target	Urban park / Residential [4] Target
SEMIVOLATILE, PAHS																	
ACENAPHTHENE	83329		1700*	520*	970*	710*				290 M	6.71	16	500	88.9	130 E		
ACENAPHTHYLENE	208968				300*C					160 M	5.87	44	640	127.87	71 E		
ANTHRACENE	120127				300*C		10			260 M	46.85	85.3	1100	245	280 E		
BENZO[K]FLUORANTHENE	207089				300*C		27.2			13,400B					1800 EI	100	1000
BENZO[A]PYRENE	50328	0.2			300*C		32.4	31.9	782	700 I	88.81	430	1600	763.22	1100 E	100	1000
BENZO[B]FLUORANTHENE	205992				300*C										1800 EI	100	1000
BENZO[GHI]PERYLENE	191242				300*C					300 M					670 M		
BENZ[A]ANTHRACENE	56553				300*C		15.72	31.7	385	500 I	74.83	261	1600	692.53	960 E	100	1000
CHRYSENE	218019				300*C		26.83	57.1	862	800 I	107.77	384	2800	845.98	950 E		
DIBENZ[A,H]ANTHRACENE	53703				300*C		10			100 M	6.22	63.4	260	134.61	230 OM	100	1000
FLUORANTHENE	206440		3980*		40*	16 *	31.46	111	2355	1,500 M	112.82	600	5100	1493.54	1300 E		
FLUORENE	86737				300*C		10			300 M	21.17	19	540	144.35	120 E		
INDENO[1,2,3-CD]PYRENE	193395				300*C		17.32			330 M					600 M	100	1000
METHYLNAPHTHALENE, 2-	91576				300*C						20.21	70	670	201.28	64 E		
NAPHTHALENE	91203		2300*	620*	2350*		14.65			600 I	34.57	160	2100	390.64	230 E	100	5000
PHENANTHRENE	85018		30 p	6.3 p	7.7 p	4.6 p	18.73	41.9	515	800 I	86.68	240	1500	543.53	660 E	100	5000
PYRENE	129000				300*C		44.27	53	875	1,000 I	152.66	665	2600	1397.6	2400 E	100	10000
LMW PAHs					300*C		76.42			5,300 M	311.7	552	3160	1442.00	1200 E		
HMW PAHs					300*C		192.95			6,500 M	655.34	1700	9600	6676.14	7900 E		
Total PAHs					300*C		264.05			12,000M	1684.06	4022	44792	16770.4			
VOLATILE, AROMATIC & HALOGENATED																	
BENZENE	71432	5	5300*		5100*	700*										8 A	8 A
BIS[2-CHLOROETHOXY]METHANE	111911		11000*C		12000*C	6400*C											
CARBON TETRACHLORIDE	56235	5	35200*		50000*											100	5000
CHLOROBENZENE	108907	100	250*C	50*C	160*C	129*C										100	1000
CHLORODIBROMOMETHANE	124481	100C	11000*C		12000*C	6400*C											
CHLOROFORM	67663	5	28900*	1240*												100	5000
DIBROMOMETHANE	74953	0.05	11000*C		12000*C	6400*C											
DICHLOROBENZENE 1,2-	95501	600	1120*S	763*S	1970*S	129*C									13 N	100	1000
DICHLOROBENZENE 1,4-	106467	75	1120*S	763*S	1970*S	129*C									110 I M	100	1000
DICHLOROBROMOMETHANE	75274	100C	11000*C		12000*C	6400*C											
DICHLORODIFLUOROMETHANE	75718		11000*C		12000*C	6400*C											

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; ❷ - CMC has been halved to be comparable to criteria derived by 1985 Guidelines.

2 Entry is lowest, reliable value among AET tests, on 1% TOC basis: I - Infaunal community impacts; M - Microtox bioassay; H - *Hyalella azteca* bioassay; † - value on dry weight basis.

3 Entry is lowest value among AET tests: I - Infaunal community impacts; A-Amphipod; B-Bivalve; M-Microtox; O-Oyster larvae; E-Echinoderm larvae; L-Larval $_{max}$; or, N- *Neanthes* bioassays.

4 Residues greater than target require remediation to levels below target for applicable land use in British Columbia: 'A' denotes a soil value intended to protect adjacent, aquatic habitat.

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Screening Quick Reference Table for Organics

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(all sediment and soil values in ppb dry weight, except as noted)

CHEMICAL	CAS No.	WATER: Maximum Contaminent Level	WATER: Ambient Water Quality Criteria [1] Freshwater CMC	WATER: Freshwater CCC	WATER: Marine CMC	WATER: Marine CCC	SEDIMENT: Freshwater Sediment: Lowest ARCs *H. azteca* TEL	SEDIMENT: Freshwater Sediment: Threshold Effects Level (TEL)	SEDIMENT: Freshwater Sediment: Probable Effects Level (PEL)	SEDIMENT: Freshwater Sediment: Upper [2] Effects Threshold (UET)	SEDIMENT: Marine Sediment: Threshold Effects Level (TEL)	SEDIMENT: Marine Sediment: Effects Range-Low (ERL)	SEDIMENT: Marine Sediment: Effects Range-Median (ERM)	SEDIMENT: Marine Sediment: Probable Effects Level (PEL)	SEDIMENT: Marine Sediment: Apparent [3] Effects Threshold (AET)	SOIL: Agri-cultural [4] Target	SOIL: Urban park / Residential [4] Target
DICHLOROETHANE 1,2-	107062		118000*	20000*	113000*											100	5000
DICHLOROETHYLENE 1,2-cis	540590	70	11600*S		224000*S											100	5000
DICHLOROETHYLENE 1,2-trans	156605	100	11600*S		224000*S											100	5000
DICHLOROPROPENE	542756		6060*S	244*S	790*S											100	5000
ETHYL BENZENE	100414	700	32000*		430*										4 EL	0.1 % A	0.1 % A
ETHYLENE DICHLORIDE	107062	5	118000*	20000*	113000*												
METHYLENE CHLORIDE	75092	5	11000*C		12000*C	6400*C										100	5000
PENTACHLOROETHANE	76017		7240*	1100*	390*	281*											
PROPYLENE DICHLORIDE	78875	5	23000*S	5700*S	10300*S	3040*S											
STYRENE	100425	100														100	5000
TETRACHLOROETHANE	79345		9320*S													100	5000
TETRACHLOROETHANE 1,1,2,2-	79345		9320*S	2400*	9020*											100	5000
TETRACHLOROETHYLENE	127184	5	5280*	840*	10200*	450*									57 I	5000 A	5000 A
TOLUENE	108883	1000	17500*		6300*	5000*										300000A	300000A
TRICHLOROBENZENE 1,2,4-	120821	70	250*C	50*C	160*C	129*C									> 4.8 E	100	1000
TRICHLOROETHANE 1,1,1-	71556	200	18000*S		31200*											100	5000
TRICHLOROETHANE 1,1,2-	79005	5	18000*S	9400*												100	5000
TRICHLOROETHYLENE	79016	5	45000*	21900*	2000*										41 N	65 A	65 A
TRICHLOROFLUOROMETHANE	75694		11000*C		12000*C	6400*C											
VINYLIDENE CHLORIDE	75354	7	11600* S		224000*S												
XYLENE	1330207	10000													4 BL	100	5000
VOLATILES, NITRILES																	
ACROLEIN	107028		68*	21*	55*												
ACRYLONITRILE	107131		7550*	2600*													

1 p - proposed; * - Lowest Observable Effect Level; C - value for chemical class; S - value for summation of isomers; ❷ - CMC has been halved to be comparable to criteria derived by 1985 Guidelines.

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3 Entry is lowest value among AET tests: I - Infaunal community impacts; A-Amphipod; B-Bivalve; M-Microtox; O-Oyster larvae; E-Echinoderm larvae; L-Larval $_{max}$; or, N- *Neanthes* bioassays.

4 Residues greater than target require remediation to levels below target for applicable land use in British Columbia: 'A' denotes a soil value intended to protect adjacent, aquatic habitat.

Sources:

Water: EPA 810-F-94-001A; EPA 570/9-91-019FS; Fed. Reg. 4 May 1995, Vol. 60 (86): 22229-22237.; Fed. Reg. 10 Dec 1998 Vol. 63(237:) 68353 - 68364; EPA, Quality Criteria for Water Summary 1994, EPA Health and Ecological Criteria Div.

Sediment: EPA 905-R96-008, Sept. 1996; J. Great Lakes Res. 22(3):624-638, 1996; Wash. Dep. Ecol. Publ. 95-308, 1995 and 97-323a, 1997; Environ. Manage. 19(1): 81 - 97, 1996; The AET Approach: Briefing Rpt. to the EPA SAB, September 1988; Gries & Waldow, Puget Sound Dredged Disposal Analysis Rept., 1996; Ecotox. (5):253-278, 1996: WAC Chapter 173-204

Soil: British Columbia Regulation 375/96, Contaminated Sites Regulation, June 13, 1997.

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Options For Selection of Analytical Methods: Inorganics

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TRACE ELEMENT	OTHER[1]	FLAME AA	FURNACE AA	ICP	EXTRACTION METHODS	
		7000B [2]	7010 [2]		Water	Soil / Sediment
ALUMINUM (Al)	6800	7020		6010B 6020A	3005A 3010A 3015A	3050B 3051A
ANTIMONY (Sb)	6200(55) 6800	7040	7041 7062 [3]	6010B 6020A	3005A 3015A	3050B 3051A
ARSENIC (As)	6200(60) 7063 7061A [3]		7060 7062 [3]	6010B 6020A	3005A 3010A 3015A 7063	3050B 3051A
BARIUM (Ba)	6200(60) 6800	7080A	7081 [3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
BERYLLIUM (Be)		7090	7091	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CADMIUM (Cd)	6200 6800	7130	7131A	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CALCIUM (Ca)	6200 6800	7140		6010B 6020A	3005A 3010A 3015A	3050B 3051A
CHROMIUM (CR), total	6200(200) 6800	7190	7191	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
CHROMIUM^{+6} (Cr^{+6})	7195 — 7199 [3]				7195 - 7199	3060A
COBALT (Co)	6200(330)	7200	7201	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
COPPER (Cu)	6200(85) 6800	7210	7211 [3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
IRON (Fe)	6200 6 800	7380	7381 [3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
LEAD (Pb)	6200(45) 6800	7420	7421	6010B 6020A	3005A 3010A 3015A 3020A	3051A
MAGNESIUM (Mg)	6800	7450		6010B 6020A	3005A 3010A 3015A	3050B 3051A
MANGANESE (Mn)	6200(240)	7460	7461	6010B 6020A	3005A 3010A 3015A	3050B 3051A
MERCURY (Hg)	4500(0.5) 6200 6800 7470A 7471B 7472 7473 7474 [3]			6020A	7470A 7472 3015A	3051A 7471B 7473 7474
MOLYBDENUM (Mo)	6200(25) 6800	7480	7481	6010B	3005A 3010A 3015A 3020A	3050B 3051A
NICKEL (Ni)	6200(100) 6800	7520	7521	6010B 6020A	3005A 3010A 3015A	3050B 3051A
POTASSIUM (K)	6200 6800	7610		6010B 6020A	3005A 3010A 3015A	3050B 3051A
SELENIUM (Se)	6200 6800 7741A 7742 [3]		7740	6010B 6020A	3005A 3010A 3015A	3050B 3051A
SILVER (Ag)	6200 6800	7760A	7761 [3]	6010B 6020A	3005A 3015A	3051A 7760 7761
SODIUM (Na)		7770		6010B 6020A	3005A 3010A 3015A	3050B 3051A
STRONTIUM (Sr)	6200(30) 6800	7780		6010B	3015A	3050B 3051A
THALLIUM (Tl)	6200 6800	7840	7841	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
TIN (Sn)	6200(85)	7870				
VANADIUM (V)	6200 6800	7910	7911	6010B 6020A	3005A 3010A 3015A 3020A	3050B 3051A
ZINC (Zn)	6200(80) 6800	7950	7951 [3]	6010B 6020A	3005A 3010A 3015A	3050B 3051A
CYANIDE (HCN)	9010B — 9014 [3]					

1 Method 6200 is Portable X-Ray; 6800 is Elemental/Isotope Mass Spec.; 4500 is Immunoassay; 7063 is ASV; where available, soil detection limits in ppm are in parentheses.

2 Except as noted, most individual procedures are proposed to be integrated into Method 7000B or 7010.

3 Includes various methods. Follow the extraction procedure detailed in the individual determinative method.

Sources:

All method numbers refer to EPA SW-846, Volume III with changes as proposed for Volume IV.

ICP's advantage is that it allows simultaneous or rapid sequential determination of many elements, but suffers from interferences. AA determinations are normally completed as single element analyses. ICP and Flame AA have comparable detection limits (within a factor of 4), but ICP-MS (6020A) can drastically improve the detection limits (e.g., an order of magnitude lower). Furnace AA generally exhibits lower detection limits than ICP or Flame-AA, and offers more control over unwanted matrix components. X-RAY and immunoassays allow field determinations.

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Options For Selection of Analytical Methods: Organics

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COMPOUNDS	FIELD METHODS [1]	GC/MS METHOD	SPECIFIC DETECTION METHOD	HPLC METHOD	EXTRACTION METHODS		CLEANUP METHOD
					Water	Soil / Sediment	
AROMATIC and HALOGENATED VOLATILES		8260B	8021B		5021 5030B 5032	5021 5032 5035	
CARBAMATES				8318 8321B	8318 8321B	8318 8321B	8318
CHLORINATED DIOXINS and FURANS			8280B 8290A		8280B 8290A	8280B 8290A 3545A	8280B 8290A
CHLORINATED HYDROCARBONS		8270D	8121		3510C 3520C 3535A	3540C 3550B	3620B 3640A
CHLORINATED PHENOXYACIDS	4015 (0.1 ppm)	8270D [2]	8151A	8321B	8151A 8321B 3535A	8321B 8151A 3545A 3580A	8151A 3620B
HALOETHERS		8270D	8111		3510C 3520C	3540C 3545 3550B	3620B 3640A
NITRILES and AMIDES		8260B	8031 8032A 8033	8315 8316	5030B — 5032 8031 8032A 8316	5031 5032 5035	8032A
NITROAROMATICS and KETONES		8270D	8091	8330A	3510C 3520C 3535A	3540C 3545 3550B	3620B 3640A
NITROAROMATICS (Explosives)	4050 (0.5 ppm) 4051 8515 (1 ppm)			8330A - 8332	8330A — 8332	8330A — 8332	8330A — 8332 3620B
NITROSAMINES		8270D	8070A		3510C 3520C 8070A	3540C 3545 3550B 8070A	3610B 3620B 3640A 8070A
NON-HALOGENATED VOLATILES		8260B	8015B		5030B — 5032	5021 5031 5032 5035	
ORGANOCHLORINES	4040 — 4042 (0.2 to 20 ppm)	8270D [2]	8081B 8275A		3510C 3520C 3535A	3540C 3545A 3550B 3562	3620B 3630C 3640A 3660
ORGANOPHOSPHATES		8270D [2]	8141B	8321B	3510C 3520C 3535A	3540C 3545A 3550B	3620B
PAHS	4035 (1 ppm)	8270D	8100 8275A	8310	3510C 3520C	3540C 3545 3550B 3561	3610B 3630 3640A 3650B
PCBS	4020 (5 ppm) 9078 (2 ppm)	8270D [2]	8082A 8275A		3510C 3520C 3535A	3540C 3545A 3550B 3665A 3562	3620B 3630C 3640A 3660 3665A
PHENOLICS	4010A (0.5 ppm)	8270D	8041		3510C 3520C	3540C 3545 3550B	3630 3640A 3650B 8041
PHTHALATES		8270D	8061A		3510C 3520C 3535A	3540C 3545 3550B	3610B 3620B 3640A
SEMI-VOLATILE ORGANICS		8270D			3510C 3520C 3535A	3540C 3545A 3550B	3640A 3650B 3660
TOTAL ORGANIC HALIDES (TOX)			9020B 9022		9020B 9022		
TOTAL PETROLEUM HYDROCARBONS	4030 (5 ppm) 9074		8015B				
VOLATILE ORGANICS		8260B	8015B 8021B		5030B — 5032	5021 5031 5032 5035	

1 Series 4000 are immunoassays and are for specific compounds within these classes (i.e., 2,4-D, TNT, RDX, and PCP). Soil detection limits are in parentheses.

2 This is not a method of choice, but rather a confirmatory method.

SOURCES:

All method numbers refer to EPA SW-846, Update III, with changes as proposed in Update IV.

Options shown are generally for chemical classes; more detailed information may be available for specific compounds

GC/MS methods allow for scanning a broad range of volatile and semi-volatile compounds, but suffer from interference and higher detection limits. Specific determination methods and HPLC methods allow for more precise determinations of specific compounds of interest.

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Guidelines for Sample Collection & Storage

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MATERIAL	CONTAINER[1]	PRESERVATION	MAXIMUM HOLDING TIME	SAMPLE SIZE
INORGANICS				
CHROMIUM^{+6} (Cr^{+6})	P,G	Cool, 4°C	24 hours	400 mL/200 g
MERCURY (Hg)	P,G	HNO_3, to pH <2	28 days	400 mL/200 g
METALS, *except* Cr^{+6} *and Hg*	P,G	HNO_3, to pH <2	6 months	600 mL/200 g
CYANIDE *by method no. 9010*	P,G	Cool 4°C, pH >12 See method 9010	14 days	1000 mL
ALPHA, BETA, AND RADIUM RADIATION	P,G	HNO_3 to pH <2	6 months	1000 mL
ORGANICS				
BENZIDINES	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL
CHLORINATED HYDROCARBONS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
DIOXINS AND FURANS	G, TLC	Cool, 4°C[3]	30 days until extraction, 45 days after extraction	1000 mL
HALOETHERS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
NITRITES	G, TLC	Cool, 4°C[3]	14 days	
NITROSAMINES	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
NITROAROMATICS AND CYCLIC KETONES	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
OIL and GREASE	G	Cool, 4°C[2]	28 days	1000 mL
TOTAL ORGANIC CARBON, *by method no. 9060*	P,G	Cool, 4°C[2] store in the dark	28 days	100 mL
TOTAL ORGANIC HALIDES *by method no. 9020 / 9021*	G, TLC	Cool, 4°C[2]	28 days	500 mL
PCBs	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PESTICIDES	G, TLC	Cool 4°C,	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PHENOLS	G, TLC	Cool, 4°C[3]	7 days until extraction, 40 days after extraction	1000 mL
PHTHALATE ESTERS	G, TLC	Cool, 4°C	7 days until extraction, 40 days after extraction	1000 mL
POLYNUCLEAR AROMATIC HYDROCARBONS	G, TLC	Cool, 4°C[3] store in the dark	7 days until extraction, 40 days after extraction	1000 mL/250 mL
PURGEABLE AROMATIC HYDROCARBONS	VOA	Cool, 4°C[2,3]	14 days	40 mL
PURGEABLE HALOCARBONS	VOA	Cool, 4°C[3]	14 days	40 mL

1 P - Polyethylene; G - Amber glass containers; TLC - Teflon-lined cap; VOA - Volatile organic analyte vial of amber glass with teflon-lined septum.

2 Adjust to pH <2 with H_2SO_4, HCl, or solid $NaHSO_4$

3 Free chlorine must be removed before addition of HCl by exact addition of $Na_2S_2O_3$

SOURCES:

EPA SW846

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impacted, background) to toxic levels. Screening with conservative, lower-threshold values (e.g., TELs) ensures, with a high degree of confidence, that any contaminant sources eliminated from future consideration pose no potential threat. Conversely, it does not necessarily predict toxicity. Upper thresholds(e.g., PELs) identify compounds which are more probably elevated to toxic levels.

Sediment quality benchmarks have been derived in a variety of ways for varying predictive goals. They are not interchangeable. Nor should they be applied without a reasonable understanding of their development, their performance, and their limitations.

For sediment-associated contaminants, dry weight concentrations are screened against published sediment quality benchmarks. Some benchmarks are available only on a TOC normalized basis, and are footnoted as such. Separate values are provided for either freshwater or estuarine and marine sediments.

The Effects Range-Low (ERLs) and Effects Range-Median (ERMs) plus the marine Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) are based upon a similar data compilations, but use different calculations. The ERL is calculated as the lower 10th percentile concentration of the available sediment toxicity data which has been screened for only those samples which were identified as toxic by original investigators. It is <u>not</u> an LC_{10}. Since the ERL is at the low end of a range of levels at which effects were observed in the studies compiled, it represents the value at which toxicity may begin to be observed in sensitive species. The ERM is simply the median concentration of the compilation of just toxic samples. It is <u>not</u> an LC_{50}. The TEL is calculated as the geometric mean of the 15th percentile concentration of the toxic effects data set and the median of the no-effect data set; as such, it represents the concentration below which adverse effects are expected to occur only rarely. The PEL, as the geometric mean of the 50% of impacted, toxic samples and the 85% of the non-impacted samples, is the level above which adverse effects are frequently expected. Freshwater TEL/PELs are based on benthic community metrics and toxicity tests results.

Apparent Effect Thresholds (AETs) relate chemical concentrations in sediments to synoptic biological indicators of injury (i.e., sediment bioassays or diminished benthic infaunal abundance). Individual AETs are essentially equivalent to the concentration observed in the highest non-toxic sample. As such, they represent the concentration above which adverse biological impacts would <u>always</u> be expected by that biological indicator due to exposure to that contaminant alone. Conversely, adverse impacts are known to occur at levels below the AET. Only the lowest of the potential AETs is listed. AET values were developed for use in Puget Sound (Washington) and are not easily compared directly to other benchmarks based on single-chemical models and broader data sources. **SQuiRT** cards have been updated with *interim* AET values *which are subject to change.*

For freshwater sediments, the Upper Effects Threshold (UET) was derived by NOAA as the lowest AET from a compilation of endpoint analogous to the marine AET endpoints. The UETs for organic contaminants are generally listed for a sediment containing 1% TOC.

Every effort has been made to ensure accuracy in these **SQuiRT** cards. However, NOAA is not liable for errors in transcription, in the original sources, or revision of values. These screening values are subject to change as new data become available. These cards may be freely reproduced and distributed, **if** they are distributed in their entirety, without modification, and properly credited to NOAA. The SQuiRT cards should be cited as:

"Buchman, M. F., 1999. NOAA Screening Quick Reference Tables, NOAA HAZMAT Report 99-1, Seattle WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration, 12 pages."

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